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Automated Data Processing - Part III

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AUTOMATED DATA PROCESSING—
PART III—EDP

Two previous installments have discussed the transition from manual systems to machine systems; in this installment the author discusses the faster machine systems— those which utilize electronic equipment.

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An automated data processing system relies on either mechanical or electronic equipment. Although mechanical or punch card systems offer significant advantages over manual systems, they require continuous human intervention and attention. The punched card system is limited because it is not capable of handling exceptions within a routine and because of its inability to make decisions in the course of processing. Mechanical systems are relatively slow and inflexible compared to stored program machines (called either computers or EDP equipment).

EDP (electronic data processing) equipment or hardware refers to the computer which performs the same functions as punched card equipment—but does it faster. Awad states, "Whereas both systems are made up of many individual pieces of equipment, the punched card system is not under a central automatic control as is the computer system."[7] A computer oriented system consists of several machines that work as one. It is capable of processing data received through a number of devices other than the punched card. Instructions are received by means of a program which is stored in the machine. It processes the unit record under the control of a control unit. All individual units are tied to the processor.

Description of EDP Hardware

Essentially the hardware consists of three parts—input, central processing, and output. Many of the input and output devices are the same and thus referred to as I/O devices. These I/O devices are the media with which man communicates with the computer. Common computer input or output can take the form of punched cards, punched paper tape, or magnetic tape. Additional input which will not be covered in this article could be a typewriter keyboard, magnetic ink character recognition, light probes, or line typewriters and remote input sharing stations.

The punched card is the same card as that previously described for use with mechanical equipment and it can be either input or output. Cards have the advantage of being easy to sort, delete, and replace without disturbing other cards. They are humanly readable and are useful as external storage medium for permanent records. However, cards cannot be folded, stapled, mutilated, bent, warped, or erased. They are bulky and slow.

A second input-output device is punched paper tape. Paper tapes are produced by special adding machines, typewriters, accounting machines, or cash registers. Like cards, tape is laid out in rows and columns, data is recorded on the tape by punching holes into it, and a character of information is represented by a punch or combination of punches in a vertical column across the width of the tape. Paper has the advantage of being easy to mail. It is a continuous length which prevents wasted space when records are short. However, paper tape has many disadvantages. It is not as durable or as convenient to store, file, or handle as the punched card; and it is difficult to delete or add information. Compared to magnetic tape, it is very slow.

Magnetic tape is a popular I/O medium for high speed, large volume applications. The tape is a plastic ribbon coated on one side with an iron-oxide material which can be magnetized. Business data are recorded in the form of tiny invisible spots on the iron-oxide of the tape by electromagnetic pulses.[8] The tape can be erased and used indefinitely. It can be encoded by a Magnetic Tape Encoder or data can be captured in punched cards or punched tape form and then transcribed on magnetic tape by a special offline data converter. Magnetic tape has the advantages of permitting an unlimited length of record, compact storage, and low cost. However, tape needs machine interpretation, lacks random accessibility, and needs care from dust and humidity.

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[7] Elias M. Awad and Data Processing Management Association, *Automatic Data Processing Principles and Procedures* (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1966), p. 130.

[8] Donald H. Sanders, *Computers in Business: An Introduction* (New York, New York: McGraw-Hill Book Company, 1968), p. 87.

In addition to the above described I/O devices, the primary output devices when the information is to be used by man rather than machine is the high-speed printer. It provides information output in the form of permanently printed characters similar to a typewriter output.

The third part of the hardware is the central processing unit. The central processor unit (CPU) contains the storage unit (often referred to as core), the arithmetic logic, and the control unit.

Storage (primary or internal) retains the program and the data which will be used during processing. This data can be numeric, alphabetic, or a combination of the two. Input to the computer is written in standard decimal or alphabetic form; however, it is converted into a code by the computer before being stored. This internal code is based on digits in various binary forms. The coded data is reconverted to decimal and alphabetic characters when printing is requested. Primary storage stores the data being processed and retains the results until needed. Because it is impossible for a computer to store all the data it needs internally, secondary storage or external memory is usually provided. Two common types of secondary storage are magnetic tape and magnetic disks. Magnetic tape is a sequential-file external storage medium as well as input medium and output medium. Sequential file means that the tape must be read in sequence; that is, the first record written on it must be read before the second record. As external memory, magnetic tape has the advantages of being compact, easy to handle, flexible, and low in cost. The drawbacks are its slow access time and the care required in tape handling and storage. Dust can cause errors. Heat and humidity destroy the data completely. The tape can break. When wound on the reel, the magnetic attractions can cause magnetic patterns on one coil to be copied on adjoining coils of tape within the reel.[9]

Magnetic disk is another medium of external storage. It is a vertical stack of magnetic metal disks similar to the records in a juke box. Disk storage is a random access file which has the ability to skip around within a file and read or write specific data without regard to sequence. Magnetic disk storage accommodates large amounts of data and has a low operating cost; however, the initial cost is high compared to magnetic tape.

The arithmetic unit must be present in ad-dition to storage to perform the arithmetic and the logic of the computer system. Logical decisions of a computer are usually limited to the ability to tell if two numbers or characters are equal or unequal, if one number is greater or less than another, and if a quantity is positive, negative, or zero. The control unit causes the primary storage and the arithmetic logic unit to be used in a logical fashion.

Robichaud explains the procedure as follows, "The input device enters instructions and data into the computer storage unit which holds the data until needed for processing. The central processing unit performs calculations and logical operations on the data. The output devices record the data processed by the computer. The control unit coordinates the operations of the other devices."[10]

EDP Software

According to Sanders, "Until the processor is given a detailed set of problem-solving instructions, it is merely an expensive and space consuming curiosity."[11] It—the computer—aids man in his work, but it cannot replace him because it is dependent upon him for explicit instructions. Writing these instructions to computers is called programming and consists of two steps; flow charting the job and coding the flow chart into a language that can be understood by a particular machine.

A flow chart is a means of presenting information and operations so that they are easy to visualize and to follow. There are two kinds of flow charts—system flow charts and program flow charts. System flow charts are primarily designed to show the flow of data through the entire data processing system, and symbols representing input, output, and general processing are frequently used. A program flow chart, on the other hand, presents a detailed graphical representation of how steps are to be performed within the machine to produce the needed output. The program flow chart is necessary for a computer oriented system and evolves from the system flow chart.[12] After the program flow chart is drawn and the logic checked, the program is coded in machine language, Autocoder, Cobol, Fortran, PL/1, or some other language. Although these are all languages with which man communicates with the computer, machine language is the only

[9] Elias M. Awad, *Business Data Processing* (Englewood Cliffs, New Jersey, Prentice-Hall, Inc., 1965), p. 183.

[10] Beryl Robichaud, *Understanding Modern Business Data Processing* (New York, New York: Gregg Division McGraw-Hill Book Company, 1966), p. 112.

[11] Sanders, *Computers in Business: An Introduction*, p. 187.

[12] *Ibid.*, p. 189.

deduction must be for the expenses incurred during the first 30 days. Therefore, if an employee is required to live in temporary quarters for a period exceeding the 30 days allowed, he should pick 30 consecutive days during which the highest expenses were incurred. Obviously, the temporary living expenses after the employee's entire family arrives at the new location will be higher than those incurred by the employee temporarily alone. Anything he deducts will be subject to the dollar limitation mentioned above.

Any expenses deducted under Section 217 in connection with selling his old residence cannot be used to reduce the amount realized on the sale of the residence for the purposes of determining gain. Nor can expenses deducted under Section 217 in connection with buying a new residence be added to the cost basis of the new residence. If he is faced with the possibility of going over the dollar limitation on his Section 217 deductions, the employee may want to do some advance planning for the purpose of determining which expenses might do him the most good where. He may derive some benefit in the future by deducting the expenses on the sale of his old residence and capitalizing the excess expenses incurred in purchasing the new residence. On the other hand, if he is in a position where he has to report some gain on the sale of the old residence, it may be beneficial to use the expenses related to such sale to reduce the gain.

The old law required that the distance of the employee's new principal place of work must be at least 20 miles further from his residence than the old place of work. The new law requires a distance relocation requirement of 50 miles. However, rather than being measured by a straight line on the map, the 50-mile test is now measured by the shortest of the more commonly traveled routes between the two points. This is clearly a help to those people who might be moving across a bay, or lake, or mountainous area where roads seldom go as "the crow flies."

The new moving expense deductions are not only available to employees, whether or not they are reimbursed, but is also now available to self-employed persons. The rules relating to self-employed persons are the same as those outlined above except for the "time" test which requires that an employee must be employed full-time at the new location for at least 39 weeks during the first year following his arrival. For the self-employed, the "time" test is 78 weeks out of the first 24 months immediately following his arrival at the new location. No less than 39 weeks must fall within the first 12 months.

The moving expenses are deductible in arriving at adjusted gross income and may be taken whether or not the taxpayer elects to take the standard deduction. A statement itemizing such expenses must be attached to the taxpayer's return.

If you feel that some of the provisions of the Tax Reform Act are unnecessarily complex, you might check out some of the provisions of the original House Bill which were deleted. The Senate Finance Committee explained their reason for deleting those provisions proposed to deal with deferred compensation as follows: "The Treasury Department recommended that this provision be deleted from the bill. . . . The Treasury also indicated there are a number of problems in the practical operation of the provision which it believed had not been solved satisfactorily." Long live the Treasury Department!

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one the machine understands.

The coded sheets are given to a key punch operator, who punches the data from each line on a separate card. If the coding sheet contains 20 instructions (lines), when 20 cards are punched. This deck of cards is referred to as the source program. After it is checked, the source program is taken to the computer and a separate program called a compiler deck is placed in front. The compiler deck, the source deck, and a deck of blank cards are loaded in the computer. The computer translates the source deck into machine language and punches out an object program on a deck of cards, on paper tape, on magnetic tape, or on disks. After the object program or machine language deck is tested for accuracy (debugged), the program is ready to use with live data. The object deck is put in the hopper of the card reader punch, followed by the deck with the data. The object program can be used over and over again whenever the application for which it was written is repeated.

Computers have the capacity to store data, to manipulate data, or to combine old data with newly entered data. The computer can do simple operations rapidly and repetitively; it is accurate; and it almost always operates at full efficiency. However, the computer must always be told exactly what to do. This means programming the machine by flow charting the job and coding the flow chart.

To be concluded